[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2014-0209; Special Conditions No. 25-559-SC]

Special Conditions: Embraer Model ERJ-190 airplane, Enhanced Flight-Vision System (EFVS).

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Embraer Model ERJ-190 airplane. This airplane will have a novel or unusual design feature associated with an enhanced flight-vision system. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: The effective date of these special conditions is **[insert date of FR publication].** We must receive your comments by **[insert date 45 days after Federal Register publication].**

ADDRESSES: Send comments identified by docket number FAA-2014-0209 using any of the following methods:

- Federal eRegulations Portal: Go to http://www.regulations.gov/ and follow the online instructions for sending your comments electronically.

- Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to http://www.regulations.gov/, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at http://DocketsInfo.dot.gov/.

Docket: Background documents or comments received may be read at http://www.regulations.gov/ at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

FOR FURTHER INFORMATION CONTACT: Dale Dunford, FAA, Airplane and Flightcrew Interface, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW, Renton, Washington 98057-3356; telephone 425-227-2239; facsimile 425-227-1320.

SUPPLEMENTARY INFORMATION:

The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions are impracticable because these procedures would significantly delay issuance of the design approval and thus delivery of the affected aircraft. In addition, the substance of these special conditions has been subject to the public-comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon publication in the *Federal Register*.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On December 10, 2012, Embraer applied for a change to Type Certificate No. A57NM to add an enhanced flight-vision system to the Embraer Model ERJ-190 airplane. The Embraer Model ERJ-190 airplane is a low-wing, conventional-tail, twin-turbofan, transport-category airplane with seating for up to 124 passengers.

The EFVS uses new and novel or unusual technology for which the FAA has no certification criteria. Title 14, Code of Federal Regulations (14 CFR) 25.773 does not permit visual distortions and reflections that could interfere with the pilot's normal duties, and was not written in anticipation of such technology. Because § 25.773 does not provide for any alternatives or considerations for such a new and novel system, it is necessary to establish safety

requirements that assure an equivalent level of safety and effectiveness of the pilot-compartment view as intended by this rule. Other applications for certification of such technology are anticipated in the near future and magnify the need to establish FAA safety standards that can be applied consistently for all such approvals. Special conditions are therefore prescribed under the provisions of § 21.16.

Type Certification Basis

Under the provisions of § 21.101, Embraer must show that the Model ERJ-190 airplane, as changed, continues to meet the applicable provisions of the regulations incorporated by reference in Type Certificate No. A57NM or the applicable regulations in effect on the date of application for the change. The regulations incorporated by reference in the type certificate are commonly referred to as the "original type-certification basis." The regulations incorporated by reference in A57NM are as follows:

14 CFR part 25, Amdts. 25-1 through 25-101 in entirety. In addition, the certification basis includes certain special conditions, exemptions, or later amended sections of the applicable part that are not relevant to these special conditions.

In addition to the applicable airworthiness regulations and special conditions, the Model ERJ 190 airplane must comply with the fuel-vent and exhaust-emission requirements of 14 CFR part 34, and the noise-certification requirements of 14 CFR part 36.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Model ERJ-190 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should

the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, the special conditions would also apply to the other model.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type-certification basis under § 21.101.

Novel or Unusual Design Features

The Model ERJ-190 airplane will incorporate the following novel or unusual design features:

Installation of an enhanced flight-vision system (EFVS).

Discussion

On January 9, 2004, the FAA published revisions to operational rules in 14 CFR parts 1, 91, 121, 125 and 135 to allow aircraft to operate below certain altitudes during a straight-in instrument approach while using an EFVS to meet certain visibility requirements.

Some Enhanced Vision Systems (EVS) were approved prior to this rule change in accordance with provisions of Special Conditions (re: ANM-SC-159) that addressed requirements for the pilot-compartment view and limited the scope of intended functions permissible under the operational rules at the time (re: § 91.175). In particular, the intended function of the EVS imagery was to present a view that aided the pilot during the approach, and which the pilot could use to detect and identify the visual references for the intended runway, as listed in 14 CFR 91.175(c)(3), down to 100 feet above the touchdown zone. However, the EVS imagery alone was not to be used as a means to satisfy visibility requirements below 100 feet, as a means to satisfy flight-visibility requirements (re: § 91.175(c)(2)), nor as flight guidance or as a

substitute for the outside view for maneuvering the airplane.

The operational rule change expands the permissible application of certain EVSs that are certified to meet the new requirements for an EFVS. The rule will allow the use of EFVS for operation between the minimum descent altitude (MDA) or decision height (DH) to meet new visibility requirements found in § 91.175(l). Consequently, the intended function of the EFVS, unlike the previously approved EVS, includes the pilot's use of the imagery to determine that the "enhanced flight visibility" is not less than the minimum visibility prescribed for the instrument approach, and may be used for maneuvering the airplane between MDA or DH, and 100 feet above touchdown-zone elevation. See Advisory Circular (AC) 20-167 for a more in-depth description of the intended function.

The EFVS uses new and novel or unusual technology that displays video-raster imagery in the field of view regulated by 14 CFR 25.773. This rule does not permit distortions and reflections in the pilot-compartment view that can interfere with normal duties and was not written in anticipation of such technology. The video image potentially interferes with the pilot's ability to see the natural scene in the center of the forward field of view.

Unlike the pilot's natural forward vision, the EFVS image is infrared-based, monochrome, two- dimensional (i.e. no depth perception), and of lower resolution than normal human vision provides. While the pilot may be readily able to see around and through small individual stroke-written symbols on the HUD, the pilot may not be able to see around or through the image that fills the display without some interference of the outside view. Nevertheless, the EFVS may be capable of meeting an equivalent level of safety when considering the combined view of the image and the outside scene, which is visible to the pilot through the image. It is essential that the pilot can use this combination of image and natural

view of the outside scene as safely and effectively as the pilot-compartment view currently available without the EFVS image.

Because § 25.773 does not expressly provide for any alternatives or considerations for such a new and novel system, it is necessary to establish safety requirements that assure an equivalent level of safety and effectiveness of the pilot-compartment view as intended by that rule. The purpose of these special conditions is to provide the unique pilot-compartment view requirements for the EFVS installation.

Compliance with these special conditions is required for the EFVS to be found acceptable for the following intended functions, in accordance with § 91.175(l) and (m):

1. Presenting an image that would aid the pilot during a straight-in instrument approach.
2. Enable the pilot to determine the "enhanced flight visibility," as required by § 91.175(l)(2) for descent and operation below MDA/DH.
3. Enable the pilot to use the EFVS imagery to detect and identify the "visual references for the intended runway" required by § 91.175(l)(3), to continue the approach with vertical guidance to 100 feet height above touchdown-zone elevation.

NOTE: The term "enhanced vision system (EVS)" has been commonly used to refer to a system comprised of a head-up display, imaging sensor(s), and avionics interfaces that display the sensor imagery on the HUD, and overlay that imagery with alpha-numeric and symbolic flight information. However, the term has also been commonly used in reference to systems that display the sensor imagery, with or without other flight information, on a head-down display. Hence, to avoid confusion, the FAA defined the term "enhanced flight-vision system (EFVS)" to refer to certain EVS systems that meet the requirements of the new rule, in particular the requirement for a HUD and specified flight information, and can be used to determine "enhanced

flight visibility." EFVS can be considered a subset of systems otherwise labeled EVS.

These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Applicability

As discussed above, these special conditions are applicable to the Embraer Model ERJ-190 airplane. Should Embraer apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on one model of airplanes. It is not a rule of general applicability.

The substance of these special conditions has been subjected to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, because a delay would significantly affect the certification of the EFVS modification to the Embraer Model ERJ-190 airplane, which is imminent, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions upon publication in the Federal Register.

The FAA requests comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Embraer Model ERJ-190 airplane.

1. EFVS imagery on the HUD must not degrade the safety of flight or interfere with the effective use of outside visual references for required pilot tasks during any phase of flight in which it is to be used.
2. To avoid unacceptable interference with the safe and effective use of the pilot-compartment view, the EFVS device must meet the following requirements:
    a. EFVS design must minimize unacceptable display characteristics or artifacts (e.g. noise, “burlap” overlay, running water droplets) that obscure the desired image of the scene, impair the pilot’s ability to detect and identify visual references, mask flight hazards, distract the pilot, or otherwise degrade task performance or safety.
    b. Control of EFVS display brightness must be sufficiently effective, in dynamically changing background (ambient) lighting conditions, to prevent full or partial blooming of the display that would distract the pilot, impair the pilot’s ability to detect and identify visual references, mask flight hazards, or otherwise degrade task performance or safety. If automatic control for image brightness is not provided, it must be shown that a single manual setting is satisfactory for the

range of lighting conditions encountered during a time-critical, high-workload phase of flight (e.g., low-visibility instrument approach).

c. A readily accessible control must be provided that permits the pilot to immediately deactivate and reactivate display of the EFVS image on demand, without removing the pilot’s hands from the primary flight controls (yoke or equivalent) or thrust control.

d. The EFVS image on the HUD must not impair the pilot's use of guidance information, or degrade the presentation and pilot awareness of essential flight information displayed on the HUD, such as alerts, airspeed, attitude, altitude and direction, approach guidance, wind-shear guidance, TCAS resolution advisories, and unusual-attitude recovery cues.

e. The EFVS image and the HUD symbols, which are spatially referenced to the pitch scale, outside view, and image, must be scaled and aligned (i.e., conformal) to the external scene and, when considered singly or in combination, must not be misleading, cause pilot confusion, or increase workload. There may be airplane attitudes or cross-wind conditions which cause certain symbols, such as the zero-pitch line or flight-path vector, to reach field-of-view limits such that they cannot be positioned conformably with the image and external scene. In such cases, these symbols may be displayed, but with an altered appearance which makes the pilot aware that they are no longer displayed conformably (for example, "ghosting").

f. A HUD system used to display EFVS images must, if previously certified, continue to meet all of the requirements of the original approval.

3. The safety and performance of the pilot tasks associated with the use of the pilot-compartment view must be not be degraded by the display of the EFVS image. Pilot tasks which must not be degraded by the EFVS image include:
    a. Detection, accurate identification, and maneuvering, as necessary, to avoid traffic, terrain, obstacles, and other hazards of flight.
    b. Accurate identification and utilization of visual references required for every task relevant to the phase of flight.
4. Appropriate limitations must be stated in the Operating Limitations section of the Airplane Flight Manual to prohibit the use of the EFVS for functions that have not been found to be acceptable.

Issued in Renton, Washington, on June 19, 2014.

Michael Kaszycki,
Acting Manager, Transport Airplane Directorate,
Aircraft Certification Service.

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